

May 15, 2023

NASA Advisory Council

ARTEMIS

Moon to Mars Overview and Status

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Outline

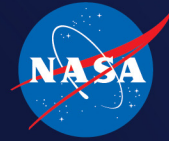


- Artemis I Accomplishments and Lessons Learned Status
- Artemis II Mission Status
- Artemis III Mission Status
- Artemis IV Mission Status
- Artemis V Mission Status
- Mars Campaign Office – Mars Risk Reduction Through Artemis



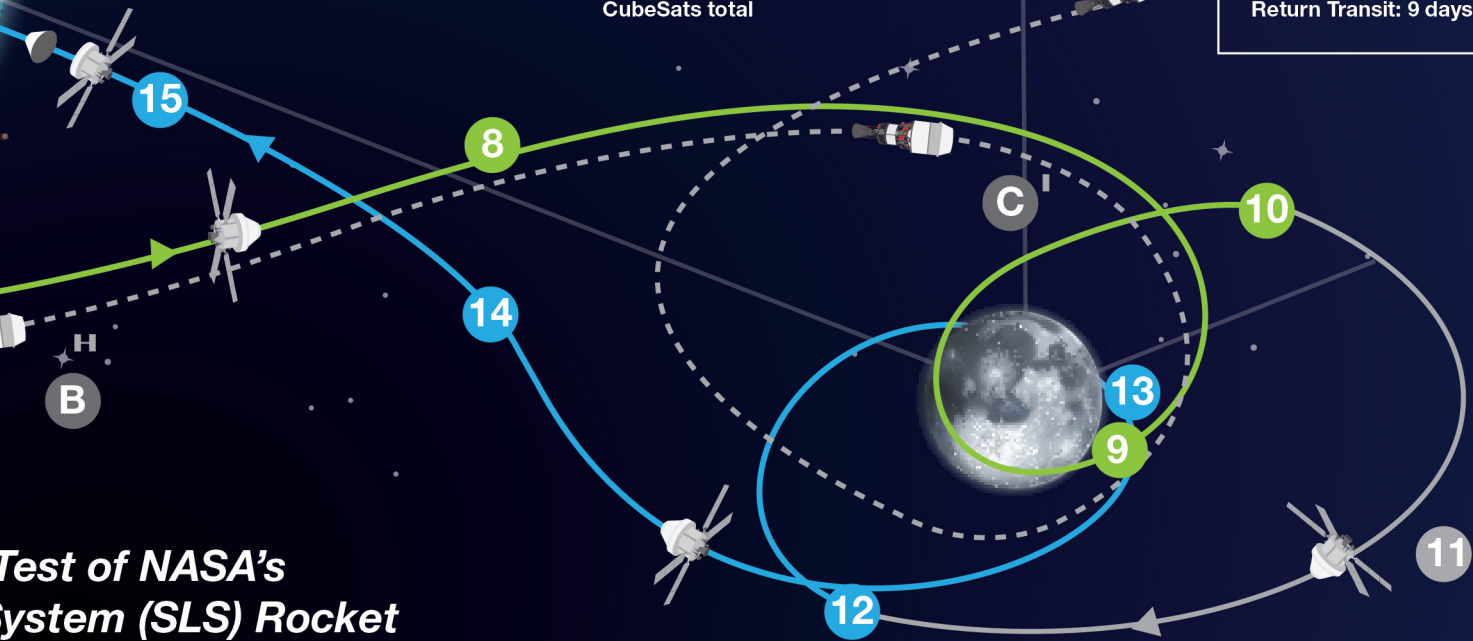
ARTEMIS

Artemis I Accomplishments and
Lessons Learned Status



A B C
CUBESATS DEPLOY
ICPS deploys 10
CubeSats total

MISSION DURATIONS:
Total: 25 days, 10 hrs
Outbound Transit: 9 days 13 hrs
DRO Stay: 6 days 0 hrs
Return Transit: 9 days 19 hrs



ARTEMIS I

The First Uncrewed Integrated Flight Test of NASA's Orion Spacecraft and Space Launch System (SLS) Rocket

1 LAUNCH (11/16/22)
SLS and Orion lift off from pad 39B at Kennedy Space Center.

2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM

3 CORE STAGE MAIN ENGINE CUT OFF with separation.

4 PERIGEE RAISE MANEUVER
5 EARTH ORBIT
Systems check with solar panel adjustments.

6 TRANS LUNAR INJECTION (TLI) BURN
Maneuver lasts for approximately 20 minutes.

7 INTERIM CRYOGENIC PROPULSION STAGE (ICPS) SEPARATION AND DISPOSAL
ICPS commits Orion to Moon at TLI.

8 OUTBOUND TRAJECTORY CORRECTION BURNS
As necessary adjust trajectory for lunar flyby to Distant Retrograde Orbit (DRO).

9 OUTBOUND POWERED FLYBY
105.5 miles from the Moon; targets DRO insertion.

10 LUNAR ORBIT INSERTION
Enter DRO.

11 DRO
Perform one-half of a revolution (6-day duration) in the orbit 43,730 miles from the surface of the Moon.

12 DRO DEPARTURE
Leave DRO and start return to Earth.

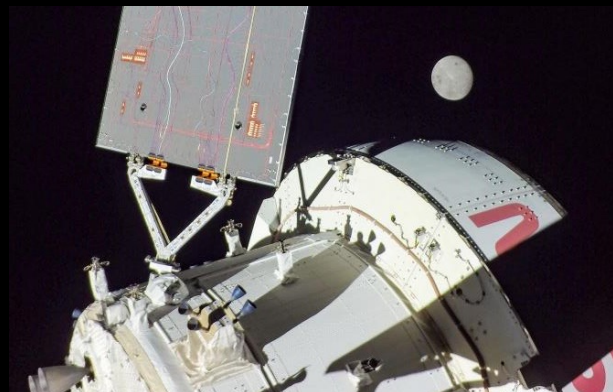
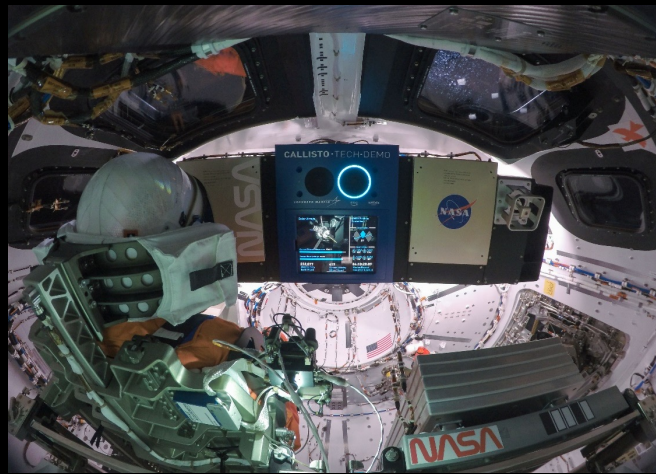
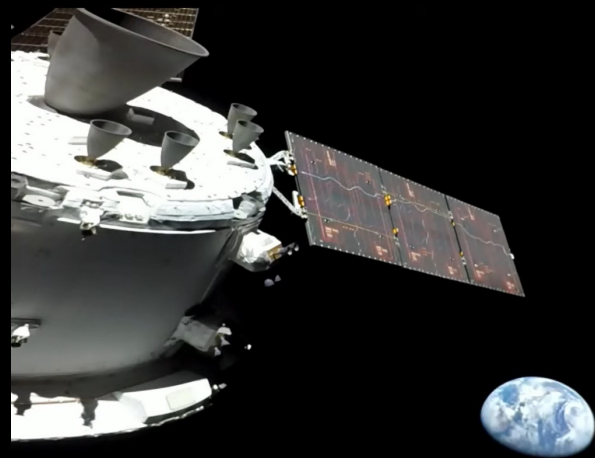
13 RETURN POWERED FLYBY (RPF)
RPF burn prep and return coast to Earth initiated. Closest approach in middle of burn, 81 miles.

14 RETURN TRANSIT
Return trajectory correction burns as necessary to aim for Earth's atmosphere.

15 CREW MODULE SEPARATION FROM SERVICE MODULE

16 ENTRY INTERFACE
Enter Earth's atmosphere.

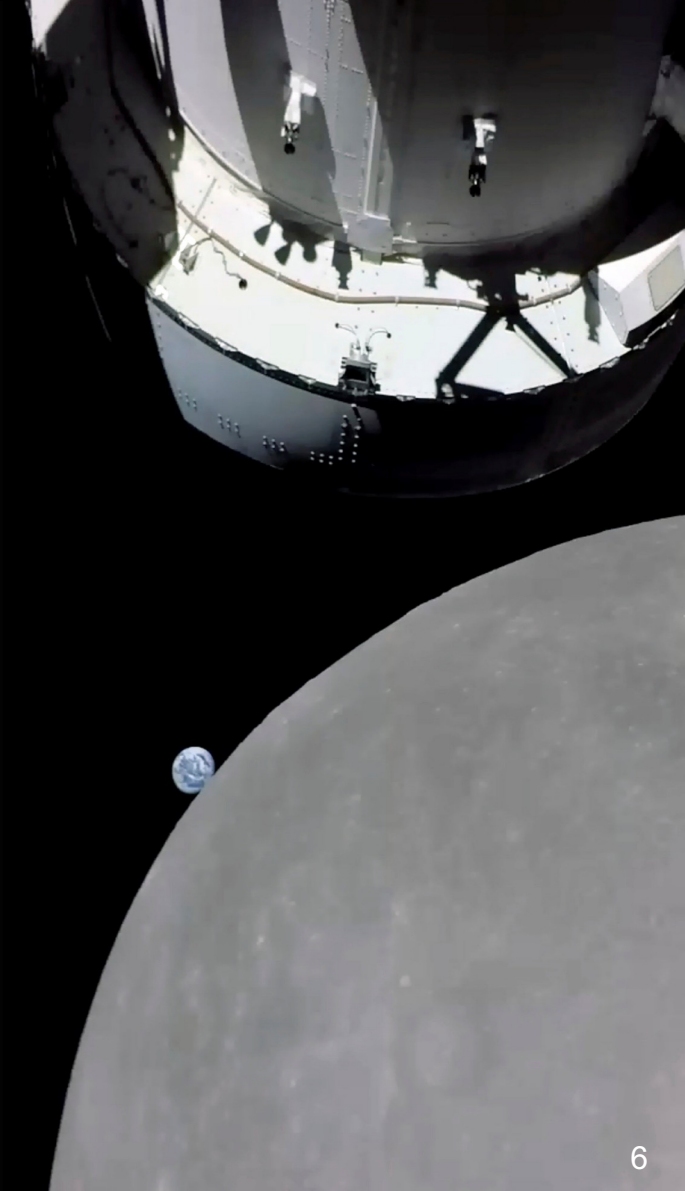
17 SPLASHDOWN (12/11/22)
Pacific Ocean landing within view of the U.S. Navy recovery ship.



Artemis I Accomplishments



- ✓ Demonstrated Orion's heat shield can withstand the high speed and heat conditions upon Earth return
- ✓ Demonstrated nominal operations and facilities during all mission phases
- ✓ Retrieved Orion after splashdown, with all procedures as expected
- ✓ Performed modal survey
- ✓ Certified optical navigation camera
- ✓ Characterized solar array wing camera Wi-Fi
- ✓ Performed crew module/service module surveys
- ✓ Demonstrated large file delivery protocol uplink
- ✓ Performed star tracker thermal assessment
- ✓ Examined radiator loop flow control
- ✓ Characterized solar array wing plume
- ✓ Characterized propellant slosh characteristics in space
- ✓ Search Acquire and Track (SAT) mode
- ✓ Gauged entry aerothermal performance
- ✓ Integrated Search and Rescue Satellite Aided Tracking, or SARSAT, functionality

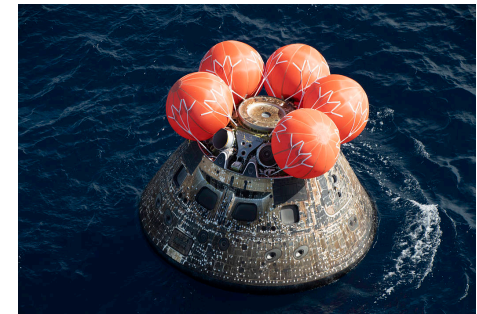
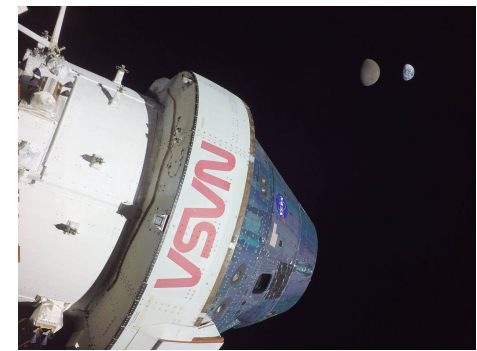
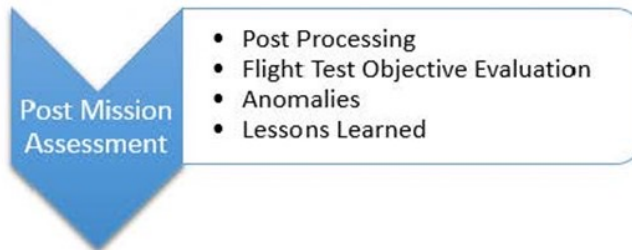


Artemis I Lessons Learned Status



Post flight assessment process:

- Postflight reconstruction
- Evaluation of mission and flight test objectives
- Evaluation and disposition of anomalies
- Collection of lessons learned



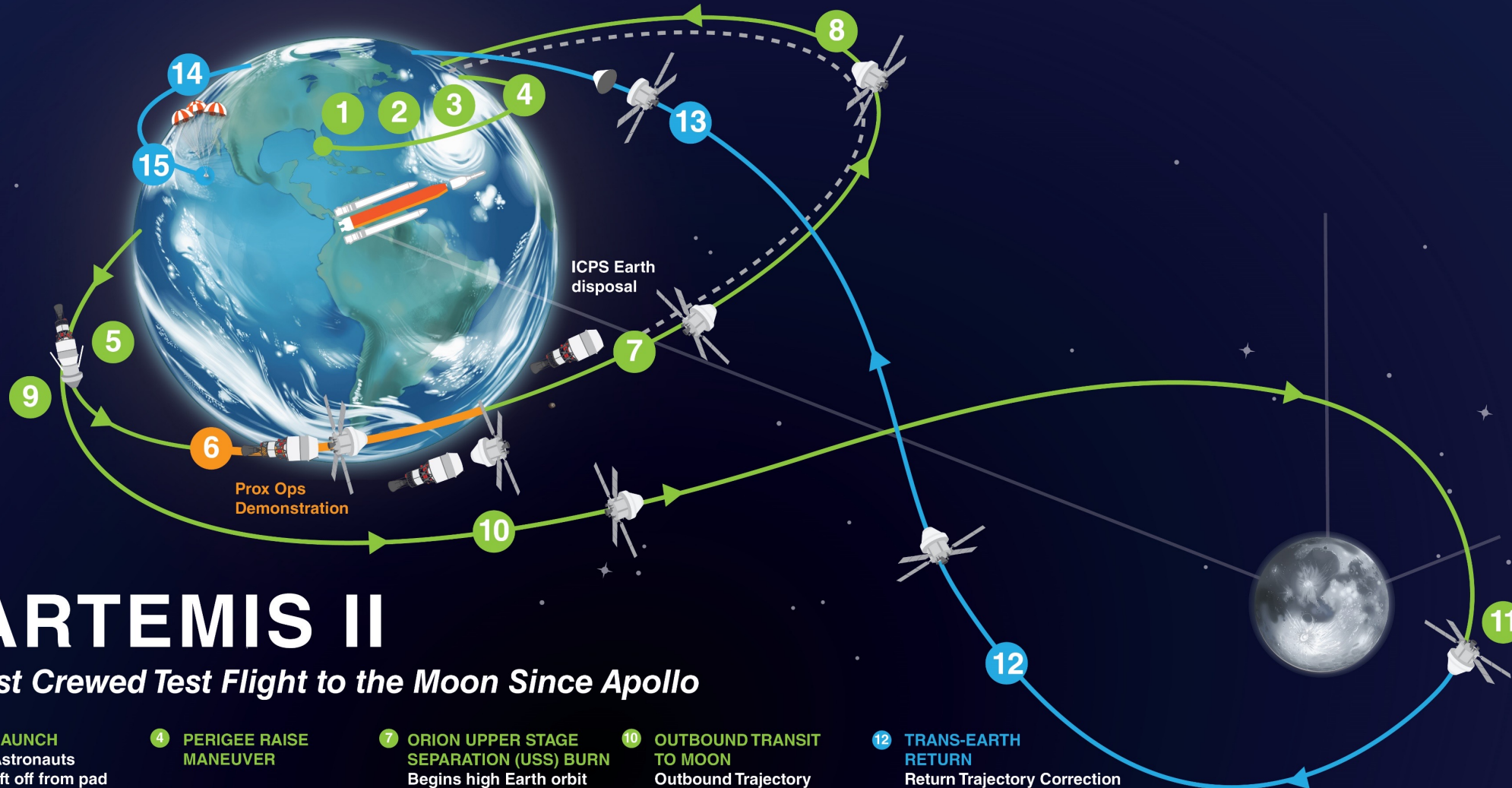
The Post Flight Assessment Review (PFAR) is conducted after each mission in accordance with NPR 7123.1, NASA Systems Engineering Process and Requirements

- This review is intended to assess the system performance and the success of mission objectives
- In addition, all flight and ground system anomalies that occurred during the mission are reviewed, and actions necessary to mitigate or resolve the anomalies for future flights are assigned
- Artemis I PFAR schedule:
EGS: April 18 (complete); Orion: June 7; SLS: June 12; ESI: June 14; ESD: June 23



ARTEMIS

Artemis II Mission Status



ARTEMIS II

First Crewed Test Flight to the Moon Since Apollo

- 1 LAUNCH**
Astronauts lift off from pad 39B at Kennedy Space Center.
- 2 JETTISON SOLID ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**
With separation.
- 4 PERIGEE RAISE MANEUVER**
- 5 APOGEE RAISE BURN TO HIGH EARTH ORBIT**
Begin 23.5 hour checkout of spacecraft.
- 6 ORION SEPARATION FROM INTERIM CRYOGENIC PROPULSION STAGE (ICPS) FOLLOWED BY PROX OPS DEMO**
Plus manual handling qualities assessment for up to 2 hours.
- 7 ORION UPPER STAGE SEPARATION (USS) BURN**
Begins high Earth orbit checkout. Life support, exercise, and habitation equipment evaluations.
- 8 PERIGEE RAISE BURN**
- 9 TRANS-LUNAR INJECTION (TLI) BY ORION'S MAIN ENGINE**
Lunar free return trajectory initiated with European service module.
- 10 OUTBOUND TRANSIT TO MOON**
Outbound Trajectory Correction (OTC) burns as necessary for Lunar free return trajectory; travel time approximately 4 days.
- 11 LUNAR FLYBY**
6,479 miles / 10,427 km (mean) lunar farside altitude.
- 12 TRANS-EARTH RETURN**
Return Trajectory Correction (RTC) burns as necessary to aim for Earth's atmosphere; travel time approximately 4 days.
- 13 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 14 ENTRY INTERFACE (EI)**
Enter Earth's atmosphere.
- 15 SPLASHDOWN**
Ship recovers astronauts and capsule.

PROXIMITY OPERATIONS DEMONSTRATION SEQUENCE	
1	9
2	10
3	11
4	12
5	13
6	14
7	15
8	16
	17

MAJOR MILESTONES FOR ARTEMIS II



PARACHUTES QUALIFIED
FOR FLIGHT



*CREW EGRESS
TRAINING AT
NBL



ORION PRESSURE
VESSEL ELEMENTS
MACHINED



*HAND
CONTROLLER
EVAL



*DOCKING HATCH
EVAL



ORION WATER
IMPACT TESTING



*CREW
EMERGENCY
EGRESS TESTS



*CREW AT SEA
TEST



*CREW MODULE
UPRIGHT
SYSTEM TEST



ORION
ENVIRONMENTAL
TESTS



HEAT SHIELD
BLOCK INSTALL
COMPLETE



SLS BOOSTER
MOTOR
SEGMENTS CAST



RS-25
ENGINES
PROCESSED



SLS CORE STAGE
PROOFING AND
WELDING



*HUMAN-IN-
THE-LOOP
TESTS



*DIVER RECOVERY
TRAINING



ORION MISSION
CONTROL
SIMULATIONS



*VACUUM
PRESSURE CREW
TEST



PRESSURE VESSEL
COMPLETE



PRESSURE VESSEL
ARRIVES AT KSC



*DISPLAY AND
CONTROL EVAL



ASSEMBLY,
INTEGRATION, AND
TESTING AT KSC



JETTISON
MOTOR
QUALIFIED



ATTITUDE
CONTROL MOTOR
QUALIFIED



SLS RL10
ENGINE
COMPLETION



CREW MODULE
TRAINING ARTICLE
TRANSPORTED TO
LETF



*EES MOCKUP
EVALUATION



*PAD EMERGENCY
EGRESS SYSTEM
60% DESIGN
REVIEW



*EMERGENCY EGRESS
SYSTEM BASKET
PROTOTYPE



LH2 SPHERE



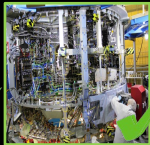
*MOBILE
LAUNCHER 1 60%
DESIGN REVIEW



ENVIRONMENTAL
CONTROL SYSTEM
CHILLERS INSTALLED



ENVIRONMENTAL
CONTROL SYSTEM
INFRASTRUCTURE
INSTALLED



EUROPEAN
SERVICE MODULE
ASSEMBLY AT
AIRBUS



EUROPEAN
SERVICE
MODULE SHIPS
TO KSC



CREW MODULE
ADAPTER/
EUROPEAN SERVICE
MODULE MATE



CORE STAGE 2
FORWARD
JOIN



CORE STAGE 2
4/5ths JOIN



CORE STAGE 2
ENGINE SECTION
BREAKOVER
COMPLETE



ARTEMIS I ORION
N/C AVIONICS
INSTALLATION IN
ARTEMIS II CREW
MODULE



SLS LAUNCH
VEHICLE STAGE
ADAPTER
COMPLETION



HEAT SHIELD
INSTALL ON
CREW MODULE



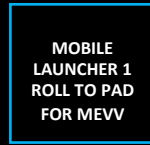
SLS INTERIM
CRYGENIC
PROPULSION
STAGE (ICPS)
READY FOR
TRANSFER TO EGS



CREW MODULE
COMPLETE



CREW AND
SERVICE
MODULE
MATE



MOBILE
LAUNCHER 1
ROLL TO PAD
FOR MEVV



CORE STAGE 2
READY FOR
SHIPMENT TO
KSC



BOOSTERS
ARRIVE AT KSC



EGS BOOSTER
OFFLINE
PROCESSING
START



*VAB ECS
UPGRADES
COMPLETE



*PAD
UPGRADES
COMPLETE



EGS
OPERATIONAL
READINESS
CHECKPOINT



*MOBILE
LAUNCHER 1
MULTI-ELEMENT
V&V AT PAD
COMPLETE



*MOBILE
LAUNCHER 1
MULTI-ELEMENT
V&V AT VAB
COMPLETE



ORION
HANDOVER TO
EGS



EGS ORION
OFFLINE
PROCESSING
START



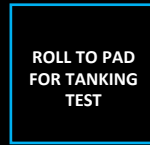
BOOSTER
STACKING
COMPLETE



SLS CORE
STAGE, ICPS, &
ADAPTERS
INTEGRATION
AT KSC



ORION MASS
SIMULATOR
MATE



ROLL TO PAD
FOR TANKING
TEST



ARTEMIS II
TANKING
TEST



ROLL TO VAB
FOLLOWING
TANKING
TEST



ORION
TO VAB



ORION
INTEGRATION
TO SLS



CONDUCT FINAL
INTEGRATED
TESTING



ROLL TO PAD
FOR LAUNCH



ARTEMIS II
LAUNCH



ARTEMIS II

Unique aspect of Artemis II
(* unique for crew config.)

Artemis II Mission Status



Mission

- Artemis II crew (Victor Glover, Christina Hammock Koch, Jeremy Hansen, and Reid Wiseman) announced on April 5, 2023
- Artemis II Mission Integration Review (MIR) planned June 6 to 8, 2023

Orion

- Crew module has completed thermal cycle testing and is proceeding with final hardware installations
- Service module continues with integrated testing

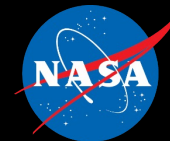
SLS

- All Artemis II hardware is or will be complete in 2023 and ready for delivery to EGS with positive margins to handover dates. Block 1 crew delta design certification review (DCR) planned for early 2024
- Core stage progress at Michoud Assembly Facility (MAF) is on plan to complete by early fall 2023; All four core stage engines were delivered to MAF, and engine installation is to complete by June 2023
- Interim cryogenic propulsion stage (ICPS) manufacturing is complete and is at United Launch Alliance (ULA) facilities at the Cape for testing and final preparations. Launch vehicle stage adaptor (LVSA) is complete and ready for delivery
- All solid rocket motor segments for Artemis II have been cast and are in storage in Utah

EGS

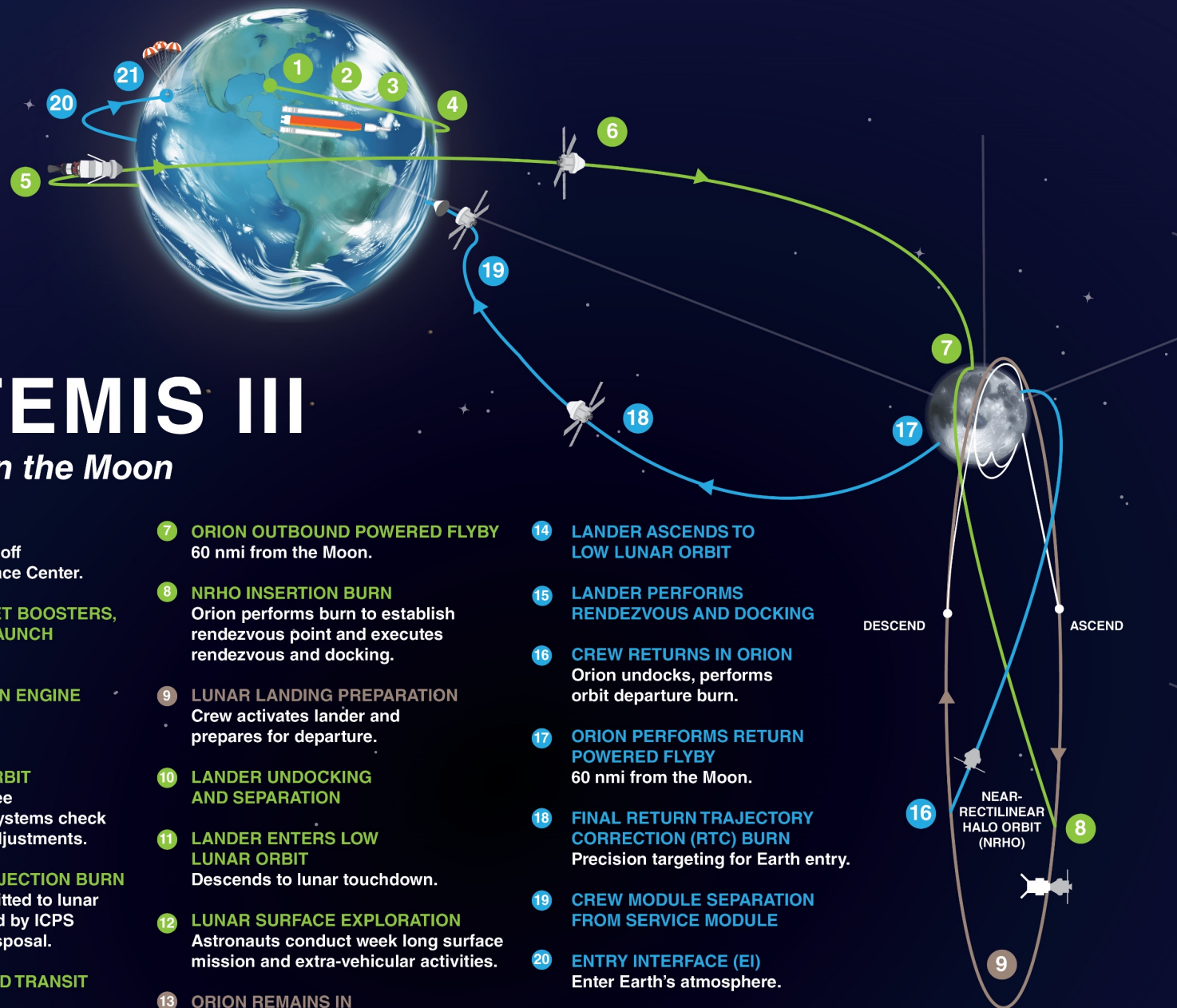
- Mobile launcher 1 (ML-1) refurbishment is on track to support Artemis II processing
- Artemis II modifications (crew access arm, emergency egress system, environmental control system in the Vertical Assembly Building and at the pad, and new 1.4-million-gallon liquid hydrogen sphere) are moving forward to support processing





ARTEMIS

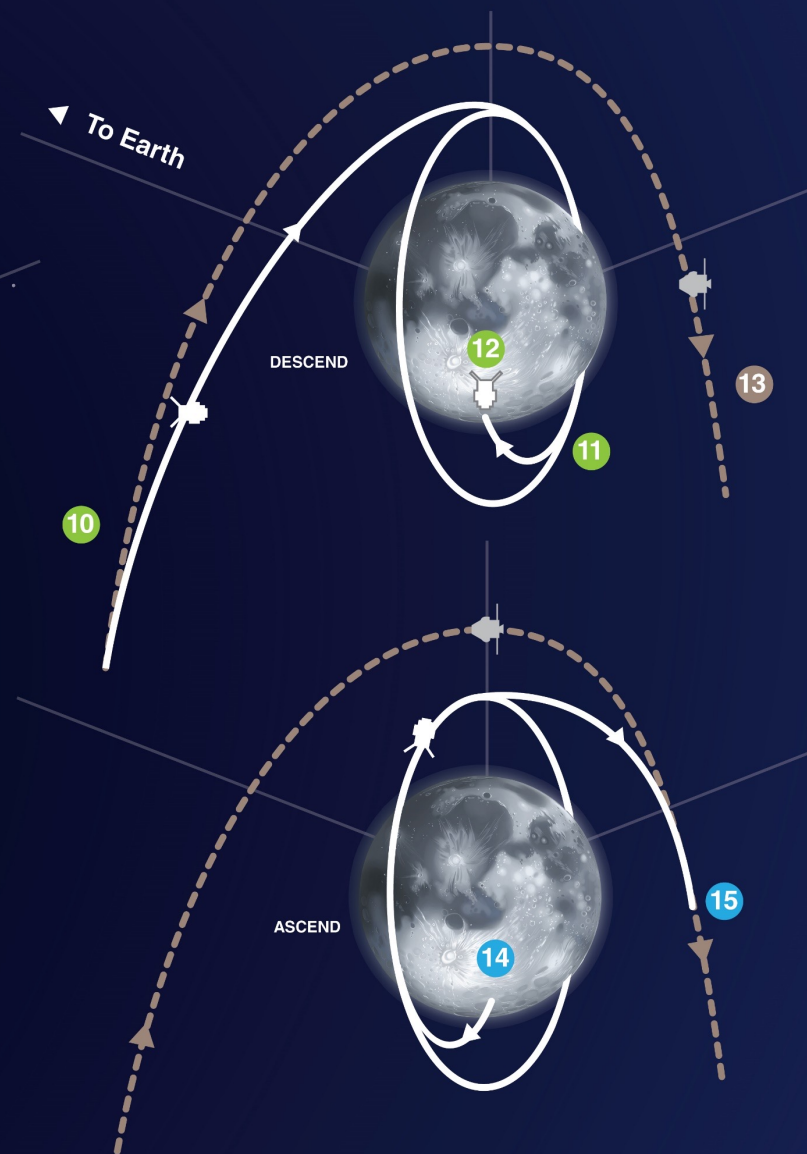
Artemis III Mission Status



ARTEMIS III

Landing on the Moon

- 1 LAUNCH**
SLS and Orion lift off from Kennedy Space Center.
- 2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**
With separation.
- 4 ENTER EARTH ORBIT**
Perform the perigee raise maneuver. Systems check and solar panel adjustments.
- 5 TRANS LUNAR INJECTION BURN**
Astronauts committed to lunar trajectory, followed by ICPS separation and disposal.
- 6 ORION OUTBOUND TRANSIT TO MOON**
Requires several outbound trajectory burns.
- 7 ORION OUTBOUND POWERED FLYBY**
60 nmi from the Moon.
- 8 NRHO INSERTION BURN**
Orion performs burn to establish rendezvous point and executes rendezvous and docking.
- 9 LUNAR LANDING PREPARATION**
Crew activates lander and prepares for departure.
- 10 LANDER UNDOCKING AND SEPARATION**
- 11 LANDER ENTERS LOW LUNAR ORBIT**
Descends to lunar touchdown.
- 12 LUNAR SURFACE EXPLORATION**
Astronauts conduct week long surface mission and extra-vehicular activities.
- 13 ORION REMAINS IN NRHO ORBIT**
During lunar surface mission.
- 14 LANDER ASCENDS TO LOW LUNAR ORBIT**
- 15 LANDER PERFORMS RENDEZVOUS AND DOCKING**
- 16 CREW RETURNS IN ORION**
Orion undocks, performs orbit departure burn.
- 17 ORION PERFORMS RETURN POWERED FLYBY**
60 nmi from the Moon.
- 18 FINAL RETURN TRAJECTORY CORRECTION (RTC) BURN**
Precision targeting for Earth entry.
- 19 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 20 ENTRY INTERFACE (EI)**
Enter Earth's atmosphere.
- 21 SPLASHDOWN**
Ship recovers astronauts and capsule.



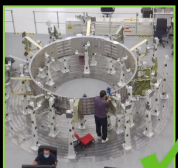
Major Milestones for Artemis III



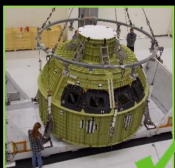
Crewed Launch
Milestones



ICPS-3 ENGINE
DELIVERY TO ULA



CREW MODULE
ADAPTER INNER
WALL DELIVERED TO
O&C



CREW MODULE
PRESSURE VESSEL
DELIVERED TO O&C



CREW MODULE
PRESSURE VESSEL
PROOF TEST
COMPLETED



MOTOR SEGMENTS
COMPLETE



SLS INTEGRATED
CRYOGENIC PROPULSION
SYSTEM PRODUCTION
COMPLETE



ENGINES READY
FOR DELIVERY TO
MAF



CONFIGURE ORION
INTEGRATED TEST
LAB FOR ARTEMIS III

ORION CREW
MODULE ADAPTER
COMPLETE

DOCKING
MECHANISM
JETTISON SYSTEM
(DMJS) DELIVERY

NASA DOCKING
SYSTEM (NDS)
COMPLETE

EUROPEAN
SERVICE MODULE
DELIVERY TO O&C

CORE STAGE 3
INTERTANK
COMPLETE

CORE STAGE 3 FWD
SKIRT COMPLETE

CORE STAGE 3 LH2
TANK COMPLETE

ORION STAGE
ADAPTER
COMPLETE

SLS LAUNCH
VEHICLE STAGE
ADAPTER
COMPLETE

CORE STAGE 3
ENGINE SECTION
COMPLETE

CORE STAGE 3 LOX
TANK COMPLETE

ORION CREW
MODULE READY
FOR MATE

ORION SERVICE
MODULE READY
FOR MATE

CREW AND
SERVICE MODULE
(CSM) MATE

BOOSTER AFT
SKIRTS COMPLETE

BOOSTER
FORWARD
ASSEMBLY
COMPLETE

START CORE STAGE 3
FINAL MATE

LAS ASSEMBLY
AND TEST
COMPLETE

CORE STAGE 3
COMPLETE

START BOOSTER
STACKING

ORION CSM
DELIVERY TO EGS

CORE STAGE
INTEGRATION

LAUNCH VEHICLE
STAGE ADAPTER
INTEGRATION

ICPS
INTEGRATION

ORION STAGE
ADAPTER
INTEGRATION

ORION MPPF
PROCESSING
COMPLETE

ORION TO VAB

ORION
INTEGRATION TO
SLS COMPLETE

ORION SPECIFIC
TESTING

CREW MODULE
STOWAGE

FINAL CLOSEOUTS FOR
LAUNCH & FSS

ROLL TO PAD FOR
LAUNCH

EGS READY FOR
ARTEMIS III
LAUNCH

HLS and EHP
Milestones

HLS -
STARSHIP/SUPER
HEAVY FLIGHT TEST

LC-39A UPDATES

PROPELLANT
TRANSFER FLIGHT
TEST

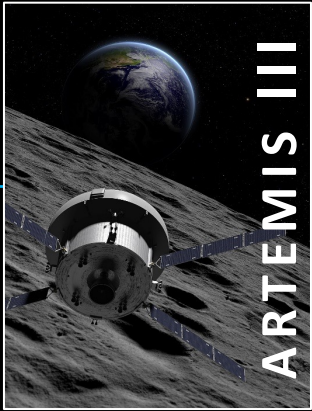
LONG DURATION
FLIGHT TEST

HLS UNCREWED
LUNAR LANDING
DEMO LAUNCH

SCIENCE
INSTRUMENT(S)
DELIVERY FOR
HLS INTEGRATION

EHP - XEVAS
READY FOR
INTEGRATION

HLS OPTION A
MISSION OPS
READY



Rev E
As of 4/27/2023

New milestones
for Artemis III

Artemis III Mission Status



Mission, Science, and Utilization

- Geospatial data team completed narrow-angle camera mosaics of all 13 landing sites
- Lunar surface science workshop held in April to gather further data and points-of-interest within the designated 13 landing regions from the science community
- Science instrument and science team selection in progress

Orion

- Artemis III build in progress; first build under Orion Production & Operations Contract (OPOC)
- Service module integration in progress in Bremen, Germany
- NASA Docking System (NDS Block 2) build in progress

SLS

- All Artemis III hardware is in manufacturing flow with completion and readiness for delivery to EGS beginning in 2024 through early 2025.
- Core stage scheduled to be complete in early 2025. All core stage engines are in storage at SSC. ICPS, LVSA, and Orion Stage Adaptor (OSA) scheduled to be complete by summer 2024
- All solid rocket motor segments for Artemis III have been cast and are in storage in Utah

EGS

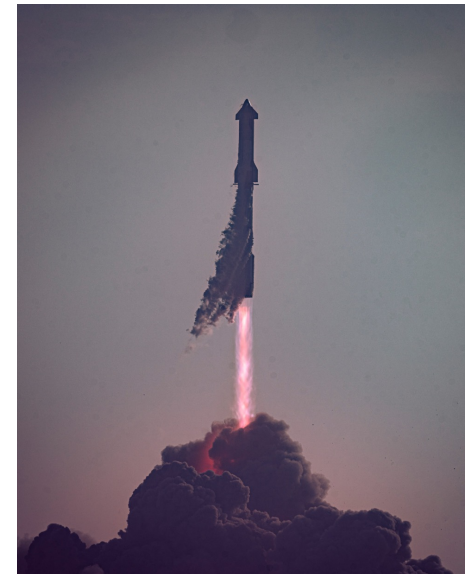
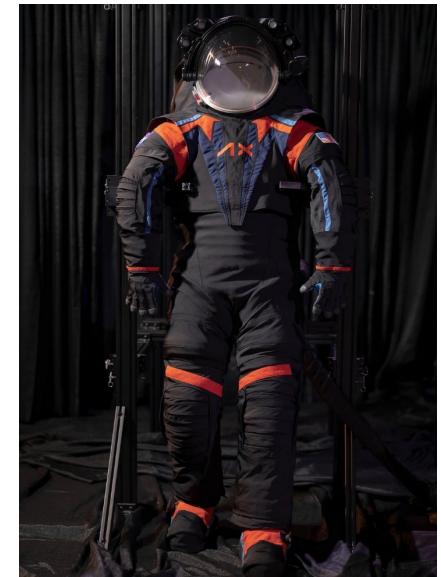
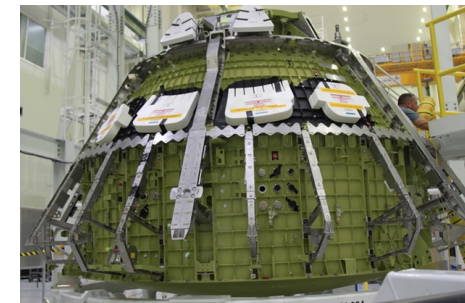
- No significant changes planned for Artemis III

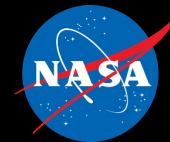
HLS

- Conducted Program Alignment Review of integrated technical baseline for KDP-C
- Starship/Super Heavy wet dress rehearsals and static fires completed at Boca Chica, Texas
- Starship/Super Heavy Flight test on April 20. Achieved ~39 km apogee. Significant data collected. Investigation underway: SpaceX-led with FAA oversight and NASA observers.

EHP

- Axiom development suit unveiled





ARTEMIS

Artemis IV Mission Status

ARTEMIS IV

International Habitation Module delivery to Gateway followed by Crewed Lunar Landing



1 LAUNCH

SLS with I-HAB co-manifested payload and Orion with 4 crew members lift-off from Kennedy Space Center.

2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM

3 CORE STAGE MAIN ENGINE CUT OFF

With separation.

4 ENTER EARTH ORBIT

Exploration Upper Stage (EUS) performs circularization of Low Earth Orbit. Systems check and solar panel adjustments.

5 TRANS LUNAR INJECTION BURN

EUS commits astronauts in Orion and I-HAB to lunar trajectory.

6 ORION TUGS I-HAB TO MOON

Orion separation from Universal Stage Adapter (USA), ejection of USA, Orion docking with I-HAB for extraction from EUS/ Payload Adapter Fitting (PAF) followed by Orion tug of I-HAB to Gateway Orbit and EUS disposal.

7 ORION OUTBOUND TRANSIT TO MOON

Requires several outbound trajectory burns.

8 ORION OUTBOUND POWERED FLYBY

60 nmi from the Moon.

9 GATEWAY ORBIT INSERTION BURN

Orion performs burn to establish rendezvous point and executes rendezvous and docking.

10 INTERNATIONAL HABITATION MODULE ARRIVAL AT GATEWAY

I-HAB docking with Orion to Power and Propulsion Element (PPE) and Habitation and Logistic Outpost (HALO) module.

11 I-HAB ACTIVATION AND CREW INGRESS

Astronauts ingress, activate and utilize I-HAB as part of larger Gateway complex.

12 LUNAR LANDING PREPARATION

Crew activates Lander and prepares for departure.

13 LANDER UNDOCKING AND SEPARATION

14 LANDER ENTERS LOW LUNAR ORBIT

Two astronauts descent to lunar touchdown.

15 LUNAR SURFACE EXPLORATION

Astronauts conduct week long surface mission including moon walks, rover ops, and surface science.

16 ORION REMAINS IN LUNAR GATEWAY ORBIT

Other two astronauts tend to Gateway during lunar surface mission.

17 LANDER ASCENDS TO LOW LUNAR ORBIT

18 LANDER PERFORMS RENDEZVOUS AND DOCKING

19 CREW RETURNS IN GATEWAY / ORION

Crew transfers science samples to Orion for return, undocks, performs departure burn.

20 ORION PERFORMS RETURN POWERED FLYBY

Lunar gravity assist, fly 60 nmi from the Moon.

21 FINAL RETURN TRAJECTORY CORRECTION BURN

Precision targeting for Earth entry.

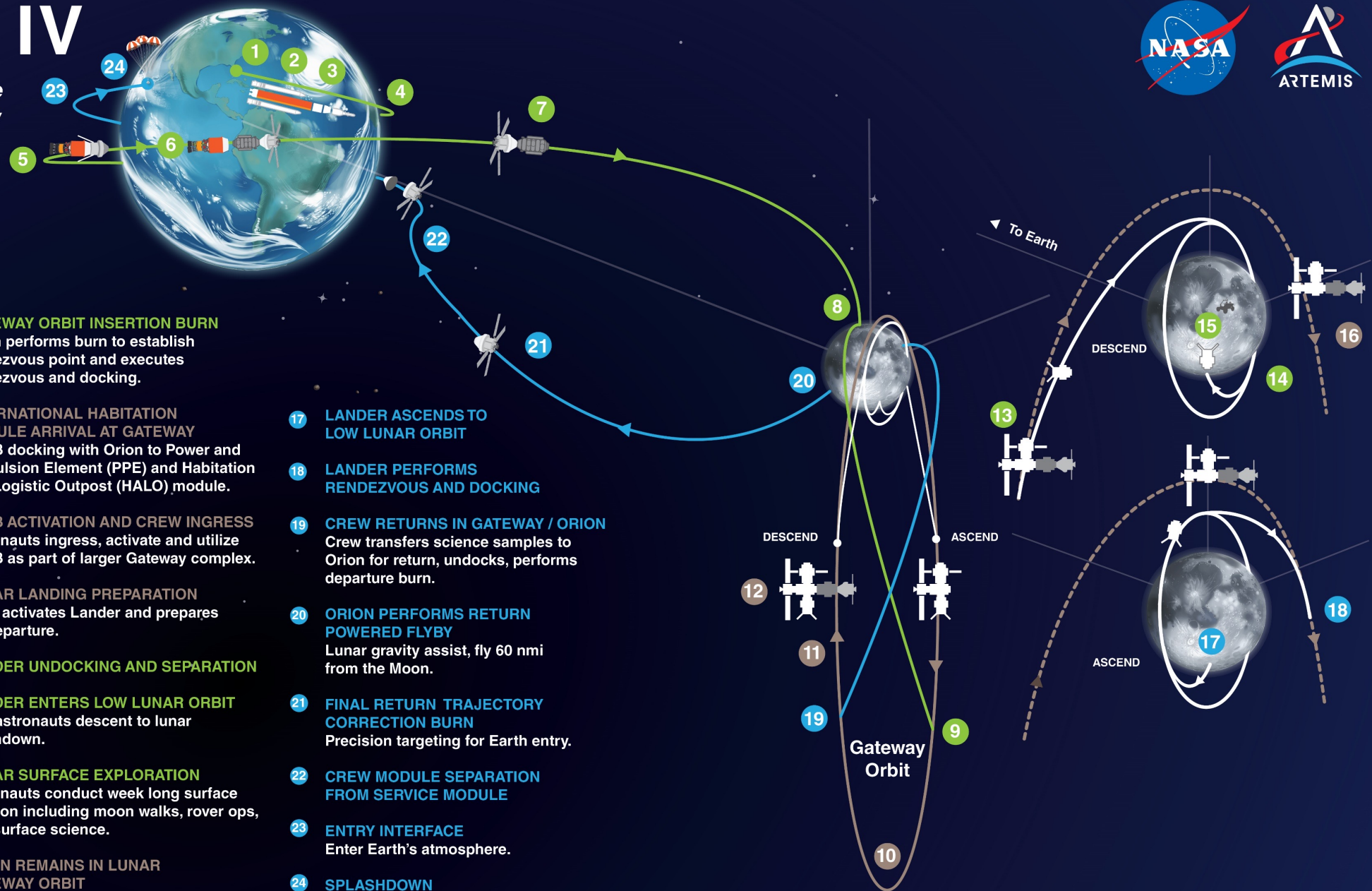
22 CREW MODULE SEPARATION FROM SERVICE MODULE

23 ENTRY INTERFACE

Enter Earth's atmosphere.

24 SPLASHDOWN

Astronaut crew, science sample and capsule recovery by ship.



Artemis IV Mission Status



Orion

- Crew module delivered to KSC and primary structure buildup is in work
- Service module integration progressing in Bremen, Germany

SLS

- Artemis IV demonstrates for the nation an initial Block 1B capability with 105t capacity to low-Earth orbit (LEO) and 38t to trans-lunar injection (TLI) with a exploration upper stage (EUS) with four RL-10 engines, a universal stage adaptor (USA), payload adaptor (PLA), and flight software
- Weld Confidence Articles (WCAs) for EUS have started, with one completed in April 2023. Five WCAs remain
- Booster motor segments casing in work and scheduled to be complete in summer 2024
- USA and PLA scheduled for completion in 2025

EGS

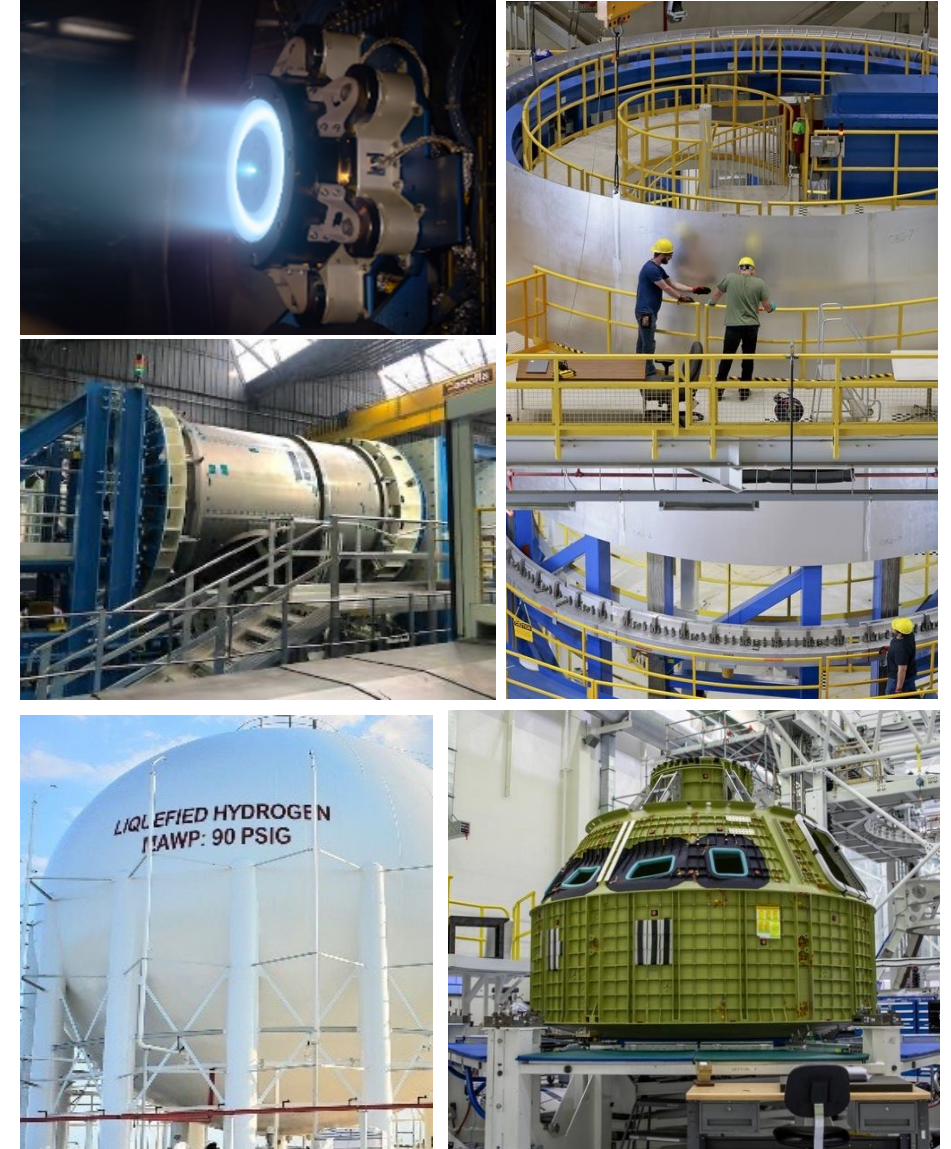
- Mobile Launcher 2 (ML-2) iCDR board held on March 9, 2023.
- Steel erection anticipated fall 2023

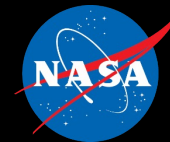
Gateway

- Completed PDR-informed sync review technical closeout in December 2022. PDR programmatic closeout planned for May 2023
- HALO completed multiple subsystem CDR closeouts and phase 2 safety panel sessions. C2 weld repair complete and teams are assessing results. Two welds remain
- PPE completed implementation review in December 2022. PPE completed end-to-end tests for both 12kW (AEPS) and 6kW (Busek) electric propulsion strings
- IHAB primary structure began in first quarter 2023. HLCS CDR completed in April 2023. ECLSS PDR closeout planned for second quarter 2023.
- Integrated analysis cycle 9 (IAC9) ongoing, with analysis to include large lander

HLS

- Awarded Option B contract mod to SpaceX (Art-IV lander) – November 2022
- Completed Preliminary Gateway Integration Checkpoint – January 2023
- Completed Standards Adjudication – March 2023





ARTEMIS

Artemis V Mission Status

ARTEMIS V

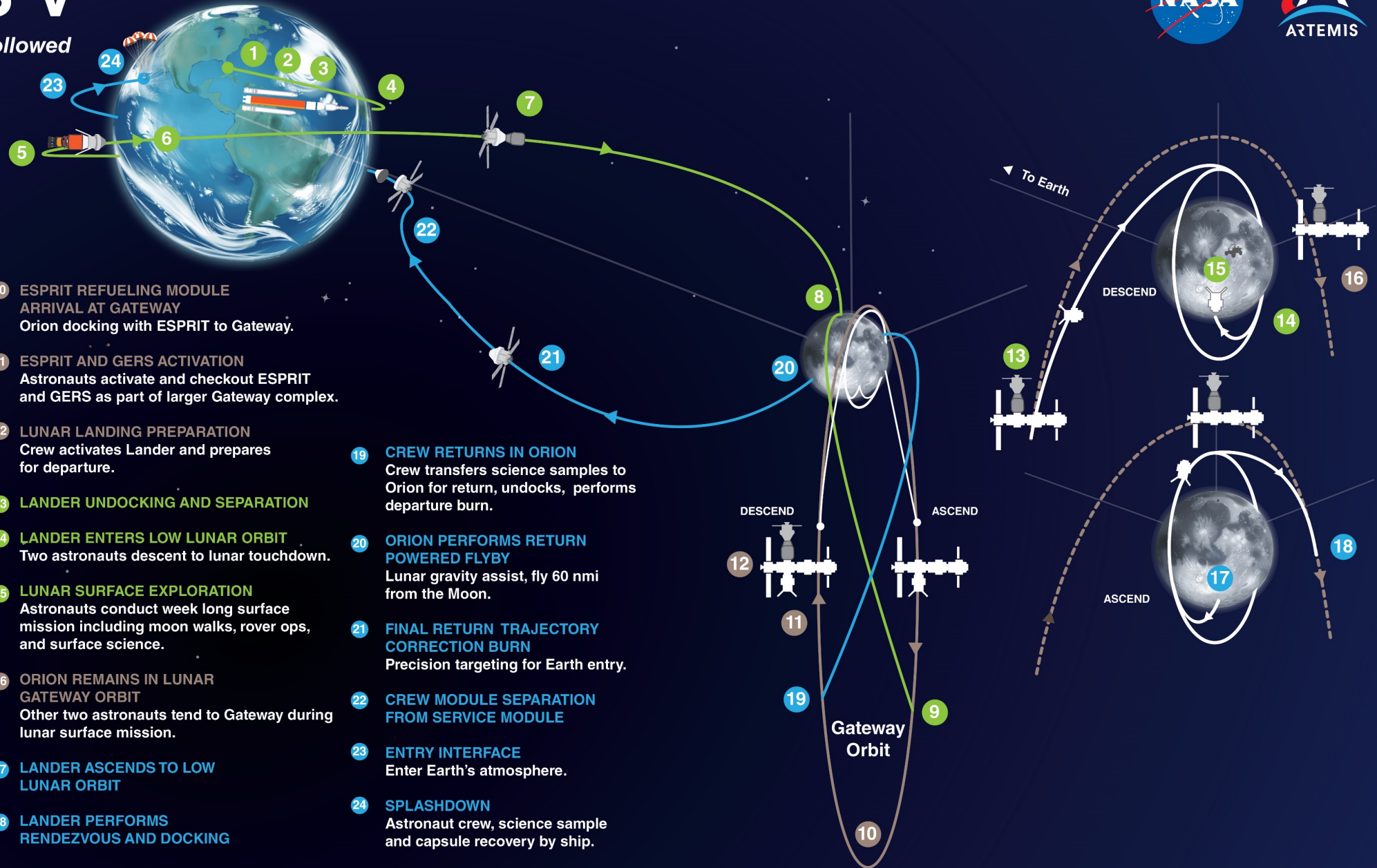
ESPRIT delivery to Gateway followed by Crewed Lunar Landing



- 1 LAUNCH**
SLS with ESPRIT payload and crewed Orion lift-off from Kennedy Space Center.
- 2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**
With separation.
- 4 ENTER EARTH ORBIT**
Exploration Upper Stage performs circularization of Low Earth Orbit. Systems check and solar panel adjustments.
- 5 TRANS LUNAR INJECTION BURN**
Exploration Upper Stage commits Astronauts in Orion and ESPRIT to lunar trajectory.
- 6 ORION TUGS ESPRIT TO MOON**
Orion separation from USA, docking with ESPRIT and extraction from USA followed by Orion tug of ESPRIT to Gateway orbit and EUS disposal.
- 7 ORION OUTBOUND TRANSIT TO MOON**
Perform periodic outbound trajectory correction maneuvers.
- 8 ORION OUTBOUND POWERED FLYBY**
Lunar gravity assist, fly 60 nmi from the Moon.
- 9 GATEWAY ORBIT INSERTION BURN**
Orion performs burn to establish rendezvous point and executes rendezvous.

- 10 ESPRIT REFUELING MODULE ARRIVAL AT GATEWAY**
Orion docking with ESPRIT to Gateway.
- 11 ESPRIT AND GERS ACTIVATION**
Astronauts activate and checkout ESPRIT and GERS as part of larger Gateway complex.
- 12 LUNAR LANDING PREPARATION**
Crew activates Lander and prepares for departure.
- 13 LANDER UNDOCKING AND SEPARATION**
- 14 LANDER ENTERS LOW LUNAR ORBIT**
Two astronauts descent to lunar touchdown.
- 15 LUNAR SURFACE EXPLORATION**
Astronauts conduct week long surface mission including moon walks, rover ops, and surface science.
- 16 ORION REMAINS IN LUNAR GATEWAY ORBIT**
Other two astronauts tend to Gateway during lunar surface mission.
- 17 LANDER ASCENDS TO LOW LUNAR ORBIT**
- 18 LANDER PERFORMS RENDEZVOUS AND DOCKING**

- 19 CREW RETURNS IN ORION**
Crew transfers science samples to Orion for return, undocks, performs departure burn.
- 20 ORION PERFORMS RETURN POWERED FLYBY**
Lunar gravity assist, fly 60 nmi from the Moon.
- 21 FINAL RETURN TRAJECTORY CORRECTION BURN**
Precision targeting for Earth entry.
- 22 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 23 ENTRY INTERFACE**
Enter Earth's atmosphere.
- 24 SPLASHDOWN**
Astronaut crew, science sample and capsule recovery by ship.





Mars Campaign Office: Mars Risk Reduction Through Artemis

Mars Campaign Office



The Mars Campaign Office (MCO) is responsible for maturing and demonstrating exploration capabilities necessary to enable human missions to Mars.

Recent accomplishments include:

- CAPSTONE
- RadWorks
- Shadow Cam
- MOXIE

Ongoing topic areas include:

- Environmental control and life support (ECLSS) evolution
- Logistics reduction
- Spacecraft fire systems
- Food systems
- Exploration medical systems
- Spacesuit physiology
- Crew health countermeasures
- Autonomous Systems and operations (AS)
- NASA Platform for Autonomous Systems (NPAS)
- Advanced Modular Power Systems (AMPS)

